National Institute of Environmental Health Sciences

A predictive model relating daily fluctuations in summer temperatures and mortality rates

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Abstract:

BACKGROUND: In the context of climate change, an efficient alert system to prevent the risk associated with summer heat is necessary. The authors' objective was to describe the temperature-mortality relationship in France over a 29-year period and to define and validate a combination of temperature factors enabling optimum prediction of the daily fluctuations in summer mortality. METHODS: The study addressed the daily mortality rates of subjects aged over 55 years, in France as a whole, from 1975 to 2003. The daily minimum and maximum temperatures consisted in the average values recorded by 97 meteorological stations. For each day, a cumulative variable for the maximum temperature over the preceding 10 days was defined. The mortality rate was modelled using a Poisson regression with over-dispersion and a first-order autoregressive structure and with control for long-term and within-summer seasonal trends. The lag effects of temperature were accounted for by including the preceding 5 days. A "backward" method was used to select the most significant climatic variables. The predictive performance of the model was assessed by comparing the observed and predicted daily mortality rates on a validation period (summer 2003), which was distinct from the calibration period (1975-2002) used to estimate the model. RESULTS: The temperature indicators explained 76% of the total over-dispersion. The greater part of the daily fluctuations in mortality was explained by the interaction between minimum and maximum temperatures, for a day t and the day preceding it. The prediction of mortality during extreme events was greatly improved by including the cumulative variables for maximum temperature, in interaction with the maximum temperatures. The correlation between the observed and estimated mortality ratios was 0.88 in the final model. CONCLUSION: Although France is a large country with geographic heterogeneity in both mortality and temperatures, a strong correlation between the daily fluctuations in mortality and the temperatures in summer on a national scale was observed. The model provided a satisfactory quantitative prediction of the daily mortality both for the days with usual temperatures and for the days during intense heat episodes. The results may contribute to enhancing the alert system for intense heat waves.

Source: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1924851

Resource Description

Exposure :

weather or climate related pathway by which climate change affects health

Temperature

Temperature: Extreme Heat

Geographic Feature: ☑

resource focuses on specific type of geography

None or Unspecified

Geographic Location: ☑

resource focuses on specific location

Non-United States

Non-United States: Europe

European Region/Country: European Country

Other European Country : France

Health Impact: ☑

specification of health effect or disease related to climate change exposure

Morbidity/Mortality

Population of Concern: A focus of content

Population of Concern: ☑

populations at particular risk or vulnerability to climate change impacts

Elderly

Resource Type: ☑

format or standard characteristic of resource

Research Article

Timescale: ☑

time period studied

Time Scale Unspecified